

Preliminary Amendment

Applicant: Ronald W. Hall et al.

Serial No.: Unknown (Parent Application Serial No. 10/000,050)

Filed: Herewith (Parent Application Filing Date November 1, 2001)

Docket No.: 10971833-3

Title: METHOD AND APPARATUS FOR PROVIDING INK TO AN INK JET PRINTING SYSTEM

IN THE SPECIFICATION

Please replace the paragraph beginning at page 2, line 23, with the following rewritten paragraph:

Another aspect of the present invention is a replaceable pump module for use with an ink jet printer having a docking bay. The docking bay includes a pump actuator and a fluid inlet fluidically coupled to a moveable print head. The pump module includes a fluid inlet configured for connection to a fluid outlet associated with a supply of ink. A fluid outlet is included that is configured for connection to the fluid inlet associated the docking bay. Also included is a pump in fluid communication with the fluid inlet and the fluid outlet associated with the replaceable pump module. The pump is actuatable by the pump actuator to draw ink from the supply of ink and provided a pressurized supply ~~the of~~ ink to the fluid inlet associated with the docking bay.

Please replace the paragraph beginning at page 4, line 1, with the following rewritten paragraph:

Figures 11A-11E are cross sectional views of a portion of the ink supply and docking bay showing the pump, actuator and out-of-ink detector of Figure 10 in various stages of operation, ~~taken along line 11-11 of Figure 10.~~

Please replace the paragraph beginning at page 6, line 10, with the following rewritten paragraph:

In the illustrated embodiment, the plastic sheets 50 are heat staked to the faces 48 of the frame in a manner well known to those in the art. The plastic sheets 50 are, in the illustrated embodiment, multi-ply sheets having a-an outer layer of low density polyethylene, a layer of adhesive, a layer of metallized polyethylene, a layer of adhesive, a second layer of metallized polyethylene terephthalate, a layer of adhesive, and an inner layer of low density polyethylene. The layers of low density polyethylene are about 0.0005 inches thick and the metallized polyethylene is about 0.00048 inches thick. The low density polyethylene on the inner and outer sides of the plastic sheets can be easily heat staked to the frame while the double layer of metallized polyethylene terephthalate provides a robust barrier against vapor

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loss and leakage. Of course, in other embodiments, different materials, alternative methods of attaching the plastic sheets to the frame, or other types of reservoirs might be used.

Please replace the paragraph beginning at page 17, line 10, with the following rewritten paragraph:

However, if the ink supply is out of ink, no ink can enter into the pump chamber 56 during a refresh cycle. In this case, the backpressure within the ink reservoir 24 will prevent the chamber 56 from expanding. As a result, when the cam 158 is rotated back into its disengaged position, the actuator 40 returns to its uppermost position, as illustrated in Figure ~~11E-11C~~, and the optical detector 186 is again activated. Activation of the optical detector immediately after a refresh cycle, informs the control system that the ink supply is out of ink (or possibly that some other malfunction is preventing the proper operation of the ink supply). In response, the control system can generate a signal informing the user that the ink supply requires replacement. This can greatly extend the life of the print head by preventing “dry” firing of the ink jets.

Please replace the paragraph beginning at page 17, line 29, with the following rewritten paragraph:

The illustrated diaphragm pump has proven to be very reliable and well suited for use in the ink supply. However, other types of pumps may also be used. For example, a piston pump, a bellows pump, or other types of fluid pressurization mechanisms that receive ink from a replaceable supply of ink and increases the fluid pressure of the ink provided to fluid inlet 42 ~~that~~ might be adapted for use with the present invention.

Please replace the paragraph beginning at page 18, line 26, with the following rewritten paragraph:

Figure 12 illustrates an alternative embodiment of an ink supply in accordance with the present invention. The pump 26 and fluid outlet 28 are generally the same as described above. The fill port 52 is optional. However, in the embodiment of Figure 12, there is no frame or flexible reservoir. Rather, the body 44 of the chassis ~~44-22~~ is received snugly by the shell 30 to define a rigid reservoir 200. In the illustrated embodiment, the body 44 is

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provided with two circumferential grooves 202, each of which receives an o-ring 204 to ensure a tight, leak-free seal between the body 44 and the shell 30. An aperture 206 is provided in the top surface of the shell 30 to allow access to the interior of the reservoir 200. In the illustrated embodiment, a cap 208 having a sealing o-ring 210 can be threaded into the aperture 206 to close the aperture. In this manner, the cap can be removed and ink added to the reservoir. A vent 212 is provided to allow the ingress of air into the reservoir 200 as ink is depleted.

Please replace the paragraph beginning at page 20, line 12, with the following rewritten paragraph:

Figures 18 – 22 depict a pump module 228 of the present invention. The pump module 228 cooperates with an ink container 230 shown in Figures 23 and 24 to provide a source of pressurized ink to the docking station 132 of the ink-jet printer. The pump module 228 and the ink container 230 together function in a ~~matter-manner~~ similar to the ink supply 20 shown in Figure 1. Features of the pump module 228 and ink container 230 that are similar to features of the ink supply 20 will be given similar reference numbers.

Please replace the paragraph beginning at page 20, line 18, with the following rewritten paragraph:

The pump module 228 is shown in more detail in Figures 18 – 21. The pump module 228 includes a fluid outlet 28' that is configured for connection to the fluid inlet 42 associated with the docking station 132. The fluid outlet 28' associated with the pump module 228 is structurally similar to the fluid outlet 28 associated with the ink supply 20 and therefore, similar numbering is used to designate this feature. Also included in the pump module 228 is a fluid inlet 42' that is configured to engage in a corresponding fluid outlet associated with the ink container 230. With the ink container 230 properly positioned on the ~~docking station~~ pump module 228, fluid communication is established between the ink container 230 and the ~~docking station-pump module 228~~.

Please replace the paragraph beginning at page 22, line 4, with the following rewritten paragraph:

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In the preferred embodiment, the pump module 228 includes keying portions 232, shown in Fig 18, that cooperate with corresponding key features established by vertical slots 138 and 140, shown in Fig 7, associated with the docking station 132. These key features 232 are positioned on the pump module 228 so that when the pump module 228 is properly positioned for insertion into the docking station 132, the key features 232 are in alignment with the proper vertical slots or grooves 138 and 140 of the docking station 132. The use of key features of 232 that interact with corresponding slot features 138 and 140 ensure that the pump module 228 is inserted into the docking station 132 such that the fluid outlet 28' is properly aligned with the fluid inlet ~~450~~42 associated with the docking station 132. In addition, these keying features 232 that interact with corresponding keying features 138 and 140 to provide a guiding and aligning function during the insertion of the pump module. This guiding and aligning function ensures that the pump module is positioned such that the actuator 40 properly engages the pump 26' to achieve the proper pumping action as well ~~ensure as ensuring~~ alignment of the fluid outlet 28' with the fluid inlet ~~450~~42.

Please replace the paragraph beginning at page 22, line 27, with the following rewritten paragraph:

The pump module 228 includes another set of keying features for ensuring a proper ink container 230 ~~as is~~ positioned to provide fluid to the proper fluid inlet 42' of the pump module 228. It is important that only the proper ink container 230 having the corresponding ink color and ink family be connected such that the proper ink is provided to the proper trailing tube 169 associated with the printing system. Mixing ink color or ink families can produce reduced print quality or failure of the printing system. The pump module 228 includes key features 236 and 238 on the pump module 228. These key features are preferably a variety of slots or grooves in the pump module 228. These key features 236 and 238 cooperate with corresponding key features 240 and 242 associated with the ink container 230. The key features 240 and 242 are preferably outwardly extending tabs. These outwardly extending tabs 240 and 242 fit into corresponding key slots 236 and 238, respectively, when the proper ink container 230 is inserted into the proper position on the pump module 228. Ink containers 230 that do not have the proper ink color or ink family are

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excluded by the keying features 236 and 238 on the pump module 228 to prevent damage to the printer or reduced print quality.

Please replace the paragraph beginning at page 23, line 23, with the following rewritten paragraph:

The ink container 230 is shown in Figures 23 and 24 in the preferred embodiment includes a reservoir 24' for containing a quantity of ink. The reservoir 24' is in fluid communication with a fluid outlet 244. The fluid outlet 244 is configured to establish fluid communication with the fluid inlet 42' associated with the pump module 228. In the preferred embodiment the fluid outlet 244 is similar to the fluid outlet 28' associated with the pump module 228 and therefore similar numbering will be used to designate similar structures. The fluid outlet 244 includes a hollow cylindrical boss 99" ~~have~~ having one end in fluid communication with the ink reservoir 24' and the other end occluded by a compliant septum 104" held in place by a crimp cover 106". A spring 100" and sealing ball 102" are positioned within the boss 99" such that the spring 100" biases the sealing ball 102" against the septum 104" to form a fluidic seal.

Please replace the paragraph beginning at page 24, line 12, with the following rewritten paragraph:

The use of the pump module 228 allows relatively low cost ink containers 230 to be used for providing ink to a semi-permanent pump module 228. In contrast to the ink supply 20, as shown in Figure 1, where the pump is replaced when the ink reservoir 24 is replaced, the pump module 228 does not need to be replaced when the ink reservoir 24' is replaced. Because the ink container 230 that contains the ink reservoir 24' does not include a pump ~~replacement of replacement~~, the ink container does not ~~the include~~ include a pump portion. Because the ink container 230 is less complex than the ink supply shown in Figure 1, the manufacturing costs tend to be lower ~~than with~~ with the ink container 230 than the ink supply 20 of Figure 1. The pump module 228 is then replaced upon failure of the pump 26' and not upon the exhaustion of ink within the ink container 230.